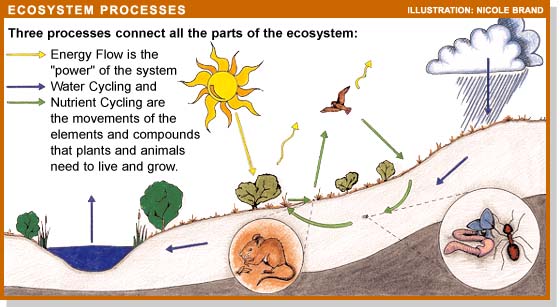
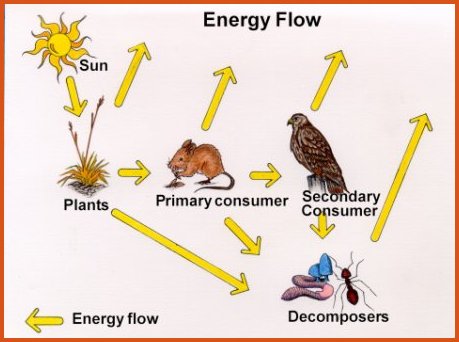
**Ecosystem Processes**



**Energy Flow**

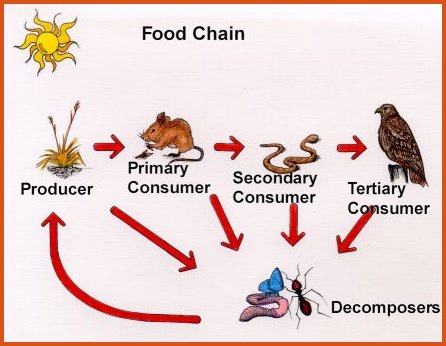
Refer to the **yellow** arrows in the diagram to help you understand the way that energy moves through an ecosystem.

Energy enters an ecosystem in the form of heat from the sun.  This energy is absorbed by organisms such as plants, and is then converted to other forms of energy and stored. Once stored, energy is used for necessary life functions, such as growth, movement and reproduction. Plants, animals and microorgnaisms release energy in the form of heat, for example through breathing and sweating. Energy is also released from an ecosystem during a fire.

Plants only capture about one percent of the energy that reaches the earth from the sun. In grasslands, that small amount of energy is used by the grasses and other plants, or **producers**. Some animals eat only these plants. Other animals eat both grasses and other plants, and animals, while yet other animals only eat animals. Animals are called **consumers.**

**Food Chain**

This movement of energy from producers to consumers is called a **Food Chain.**

**are found in two parts of an ecosystem. The "grazing" food chain includes the producers and consumers that cycle energy from living plants. The "detritus" food chain cycles energy from non-living remains of both plants and animals (also called detritus).**

**The "grazing" food chain has a number of steps that start with the producers, or the plants, and flows through a series of levels of consumers. At each step only about 10% of the energy is passed up through the chain. The rest is passed back into the atmosphere as heat through breathing and decomposition.**

**In the first step plants convert the sun’s energy to chemical energy through a process called photosynthesis. The chemical energy is stored both as food and as structural elements in the plant.**

**The next step involves the primary consumers, animals that eat only plants. In a grassland ecosystem this includes animals such as California Bighorn Sheep, Mule Deer, Elk, marmots, Pocket Gopher and mice. At step three are the secondary consumers, also called predators; these animals eat primary consumers. In a grassland ecosystem this includes a Coyote eating a mouse, a woodpecker eating an ant, or a frog eating an insect. At step four are the tertiary consumers that eat secondary consumers, and sometimes primary consumers as well. In a grassland ecosystem this includes a snake eating a frog.**

**The "detritus" food chain is a system where the energy produced by the breakdown of dead plant and animal matter is cycled into the "grazing" food chain. Detritus is organic matter formed by decaying animal or plant tissue, or fecal matter. Detritus eaters (or detritivores) such as insects, worms and other small organisms feed on dead plants, waste products from animals and dead animals. Decomposers are fungal or bacterial organisms that work within the dead material to help break it down, activating decay and decomposition. This important part of the ecosystem takes the last of the energy that was originally absorbed by the plants and returns it to the soil.**

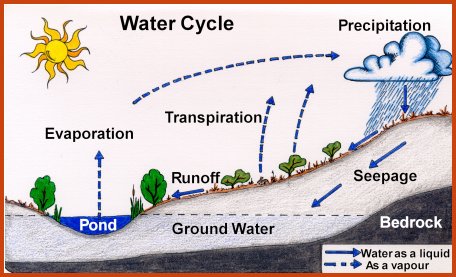
**Carbon can be traced through the ecosystem in a cycle that is similar to the water cycle. Plants take in carbon in the form of carbon dioxide from the atmosphere through respiration. Through a process called photosynthesis, the carbon dioxide combines with oxygen to form carbohydrates that range from simple sugars to the complex carbohydrate cellulose, which forms cell walls. When plants are eaten the carbon is transferred to the consumers. As plant material is broken down in the digestive system of an animal, carbon is absorbed as a nutrient for use by that animal. It is released back into the atmosphere as carbon dioxide through respiration and through the decomposition of dead animals and fecal matter. Grassland fires also release carbon dioxide into the atmosphere.**

**Water Cycling**

**All organisms require both water and nutrients (food) to survive.**

**Where do the water and nutrients come from and how do they move around a grassland ecosystem?**

**The water cycle is illustrated by the blue parts of the diagram.**

**Water exists in three forms: solid (ice and snow), liquid and gas (water vapour). Water is the vital link between the ecosystem and the weather or climate.**

**Water falls from clouds onto the grasslands as rain or snow.**

**Rain runs off plants and rocks onto the ground, where some water is absorbed into the soil. The rest runs over the surface of the ground and collects in low areas to form into wetlands, lakes and rivers.  Finally, some water that reaches the ground is evaporated back into the atmosphere.**

**Snow, which is crystallized water droplets, may form a blanket over the grasslands during the winter. Snow undergoes similar processes to rain when it reaches the ground. Some of it evaporates back into the atmosphere, and as snow melts, the water produced is absorbed into the soil, or runs over the ground into wetlands, lakes and rivers.**

**Plants take up some of the water contained in the soil through their roots. Other water that permeates (soaks through) the soil flows into wetlands, lakes, and rivers. The rest becomes part of the water table. The water table is water that remains in the soil, filling the pores between rocks and soil particles. Water is returned to the atmosphere as water vapour through evaporation and transpiration. Transpiration is a process performed by plants whereby water molecules leave the plant's surface through evaporation.**

**The water that reaches wetlands, lakes and rivers flows eventually to the ocean, with some of it evaporating along the way. Evaporation provides the moisture in clouds that condenses to form droplets of rain or snow. These droplets of water return to the earth as precipitation, and the cycle starts again.**

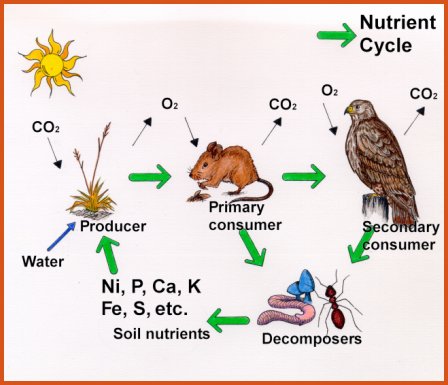
**The portions of grassland ecosystems that occur in low elevations and especially on south-facing slopes suffer from a water deficit during the hottest and driest months of the year. The amount of water that is released into the atmosphere through transpiration and evaporation is larger than the amount that falls as rain at this time of year. Grassland plants have adopted a variety of ways to survive under these difficult growing conditions.**

**Bright yellow sagebrush buttercups are some of the earliest flowers to be seen in the grasslands early spring. They start to grow before all the snow has left the grasslands, their shallow roots take advantage of all the water stored in the thawed upper layers of the soil. By the end of May the available moisture is well below the reach of the roots of the plants, and little remainsof the sagebrush buttercup but some dried out leaves.**

**Plants such as low pussytoes and silky lupine start growing a little later in the spring and bloom before the summer drought begins. They may grow again as soil moisture increases after fall showers. Some of the bunchgrasses have a similar early growth habit but become semi-dormant during the summer drought. They put on a significant amount of growth when fall rains arrive. Deeply-rooted shrubs such as big sagebrush and rabbitbrush start growing later in the year and are covered with yellow flowers in the fall.**

**Nutrient Cycling**

**The nutrient cycle follows the green parts of the diagram below.**

**Nutrients combine with water in the soil and are transported through the roots of the plant to those parts that need them. They are then passed through the food chain as the consumers eat the plants and each other. The final decomposition of both producers and consumers returns the nutrients back to the soil.**